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Bruce P. Lanphear,^{1,6} Richard Hornung,^{1,2,6} Jane Khoury,^{1,6} Kimberly Yolton,¹ Peter Baghurst,³ David C. Bellinger,⁴ Richard L. Canfield,⁵ Kim N. Dietrich,^{1,6} Robert Bornschein,⁶ Tom Greene,⁷ Stephen J. Rothenberg,⁸ Herbert L. Needleman,⁹ Lourdes Schnaas,¹⁰ Gail Wasserman,¹¹ Joseph Graziano,¹¹ and Russell Roberts.¹²

¹Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, USA; ²Institute for Health Policy and Health Services Research, Department of Environmental Health, University of Cincinnati, Cincinnati, Ohio, USA; ³Women and Children's Hospital, North Adelaide, South Australia; ⁴Department of Neurology, Children's Hospital Boston and Harvard Medical School, Boston, Massachusetts, USA; ⁵Division of Nutritional Sciences, Cornell University, Ithaca, NY, USA; ⁶Department of Environmental Health, University of Cincinnati College of Medicine, Cincinnati, Ohio, USA; ⁷Department of Biostatistics and Epidemiology, The Cleveland Clinic Foundation, Cleveland, Ohio, USA; ⁸Center for Research in Population Health, National Institute of Public Health, Cuernavaca, Morelos, Mexico and Drew University, Los Angeles, California, USA; ⁹University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA; ¹⁰National Institute of Perinatology, Mexico City, Mexico; ¹¹Columbia University, New York, New York, USA; ¹²Griffith University, Queensland, Australia

Page proofs to express mail address: Bruce P. Lanphear, M.D., M.P.H.
Cincinnati Children's Hospital Medical Center
2800 Winslow Avenue
Mail Location 7035
Cincinnati, Ohio 45206
TEL: (513) - 636-3778
FAX: (513) - 636-4402
E-mail: bruce.lanphear@chmcc.org

Correspondence and reprint requests: Bruce P. Lanphear, M.D., M.P.H.
Cincinnati Children's Hospital Medical Center
3333 Burnet Avenue
Mail Location 7035
Cincinnati, Ohio 45229-3039
TEL: (513) - 636-3778
FAX: (513) - 636-4402
E-mail: bruce.lanphear@chmcc.org

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Abbreviations:

WHO:	World Health Organization
CDC:	Centers for Disease Control
WISC-R:	Wechsler Intelligence Scale for Children-Revised
WISC-III:	Wechsler Intelligence Scale for Children-III
WPPSI:	Wechsler Preschool and Primary Scales of Intelligence
WISC-S:	Wechsler Intelligence Scale for Children-Spanish Version
HOME Inventory:	Home Observation for Measurement of the Environment
AUC:	area-under-the-curve

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Abstract

Lead is a confirmed neurotoxin, but questions remain about lead-associated intellectual deficits at blood lead levels < 10 micrograms per deciliter ($\mu\text{g/dL}$) and whether lower exposures are, for a given change in exposure, associated with greater deficits. The objective of this study is to examine the association of intelligence test scores and blood lead concentration, especially for children who had maximal measured blood lead levels $< 10 \mu\text{g/dL}$. We examined data collected from 1,333 children who participated in 7 international population-based longitudinal cohort studies, followed from birth or infancy until 5-10 years of age. The full scale IQ score was the primary outcome measure. The geometric mean blood lead concentration of the children peaked at $17.8 \mu\text{g/dL}$ and declined to $9.4 \mu\text{g/dL}$ by 5 to 7 years of age; 244 (18%) children had a maximal blood lead $< 10 \mu\text{g/dL}$ and 103 (8%) had a maximal blood lead $< 7.5 \mu\text{g/dL}$. After adjustment for covariates, we found an inverse relationship between blood lead concentration and IQ score. Using a log-linear model, there was a 6.9 IQ point decrement (95% CI=4.2, 9.4) associated with an increase in concurrent blood lead levels from $2.4 \mu\text{g/dL}$ to $30 \mu\text{g/dL}$. The estimated IQ point decrements associated with an increase in blood lead from $2.4 \mu\text{g/dL}$ to $10 \mu\text{g/dL}$, $10 \mu\text{g/dL}$ to $20 \mu\text{g/dL}$ and $20 \mu\text{g/dL}$ to $30 \mu\text{g/dL}$ were 3.9 (95% CI=2.4, 5.3), 1.9 (95% CI=1.2, 2.6) and 1.1 (95% CI=0.7, 1.5), respectively. For a given increase in blood lead, the lead-associated intellectual decrement for children with a maximal blood lead level $< 7.5 \mu\text{g/dL}$ was significantly greater than that observed for those with a maximal blood lead level $\geq 7.5 \mu\text{g/dL}$ ($p= 0.015$). We conclude that environmental lead exposure in children who have maximal blood lead levels $< 7.5 \mu\text{g/dL}$ is associated with intellectual deficits.